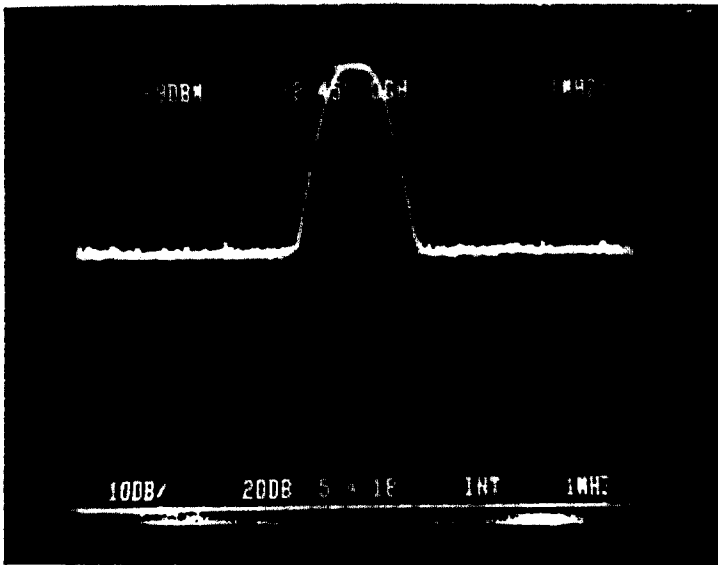


King Ranch, Texas

Diversified Communications Engineering

Reference
Level
dBm_i

-84



Date: October 7, 1997
Calibration Photograph
Center Freq: 12450 MHz
Span/Div: 1 MHz
Res. Bandwidth: 1 MHz
Amplitude/Div: 10 dB

-9 dBm, 12450 MHz signal indication on the spectrum photograph represents a -50 dBm signal being injected at the point where the test cable connects to the output of the test antenna.

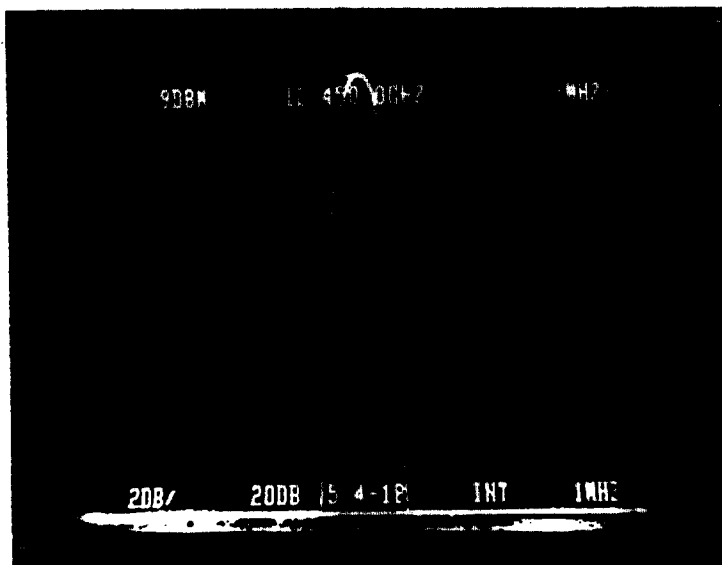
Top Reference Level is equal
-50 dBm injected signal
-34 dB antenna gain

-84 dBm_i

(A)

Reference
Level
dBW_i

-84



Date: October 7, 1997
Calibration Photograph
Center Freq: 12450 MHz
Span/Div: 1 MHz
Res. Bandwidth: 1 MHz
Amplitude/Div: 2 dB

-9 dBm, 12450 MHz signal indication on the spectrum photograph represents a -50 dBm signal being injected at the point where the test cable connects to the output of the test antenna.

Top Reference Level is equal
-50 dBm injected signal
-34 dB antenna gain

-84 dBm

(B)

Figure 2.3-4 RF Calibration Photograph (Long Cable)

2.4 Experimental Microwave System Calibration

After discovering that the Channel Master Receive Antenna supplied with the system was either defective or more likely the wrong antenna, it was decided to utilize the RCA DBS System antenna and amplifier (Figure 2.4-1). This antenna mounted on a stable telescopic mast with full azimuth and elevation rotors.

For this reason the output of the DBS ant./amp. was connected to the video rcvr./decoder and the 494P analyzer with a 2-way power divider. The transmitter isotropic level at each site as determined with the Comsearch test system was then directly referenced to the level as seen on the analyzer through the DBS System thereby establishing an L-band isotropic level from the transmitter.

It should be noted that the same power divider and cables were utilized at all times when the RCA DBS System was used either with the microwave receiver or a DBS receiver.

Terrestrial System Receive Block Diagram

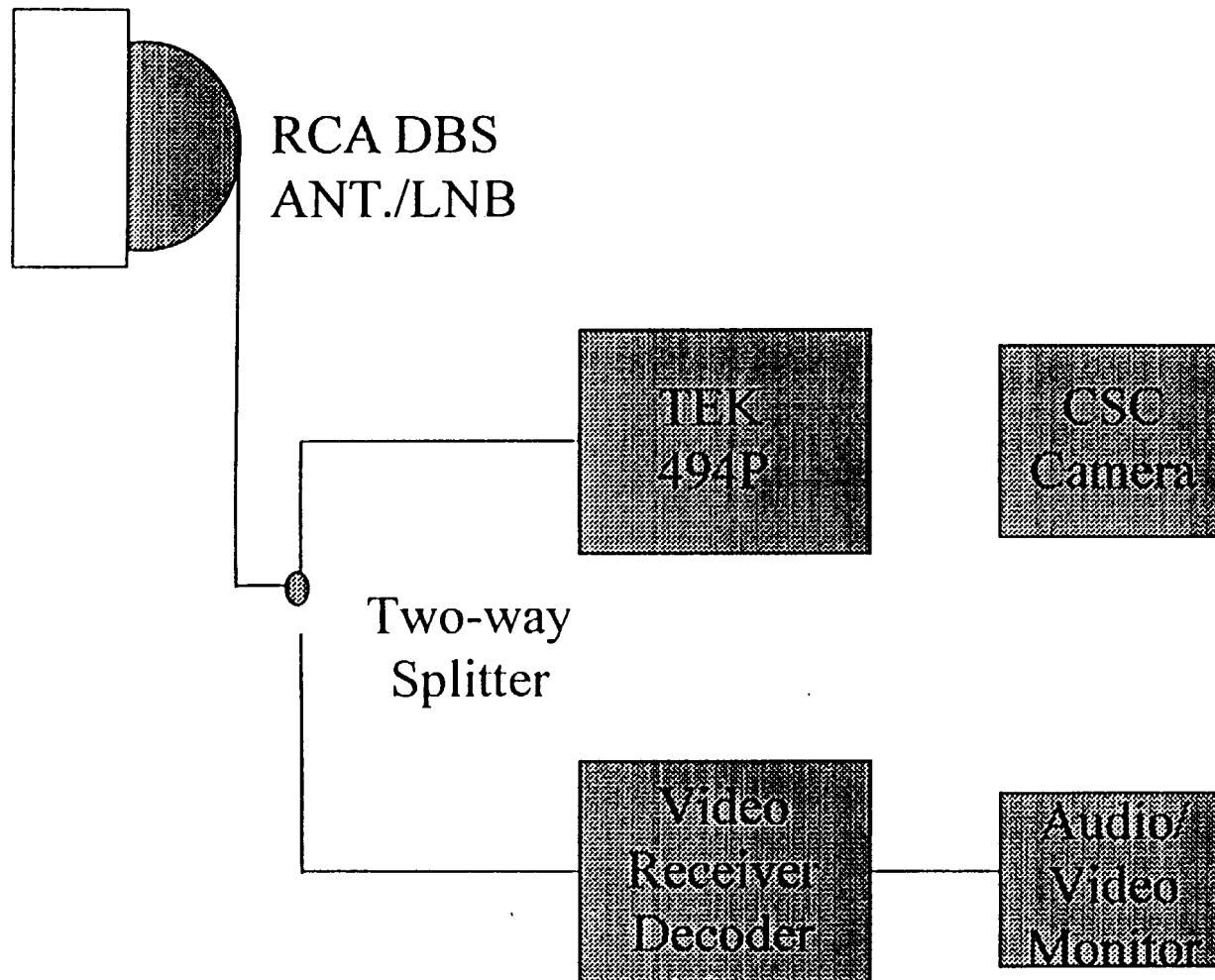


FIGURE 2.4-1

2.5 DBS Systems Configuration and Verification

Two complete DBS systems were to be used for these tests: an RCA DIRECTV System (Figure 2.5-1) and an ECHOSTAR System. Since the ECHOSTAR System was delivered with a faulty LNB, it was decided to use the RCA DBS antenna and LNB for all tests.

The output of the RCA System was connected to a 2-way power divider and connected to the 494P analyzer and either the DIRECTV or the ECHOSTAR receivers as appropriate.

Since the isotropic level of the microwave interference was determined with the Comsearch calibrated test system, an L-band isotropic reference was established at each location based on the tests as documented in Section 3. This was possible since the same divider and cables were used at all times.

DBS Receive Block Diagram

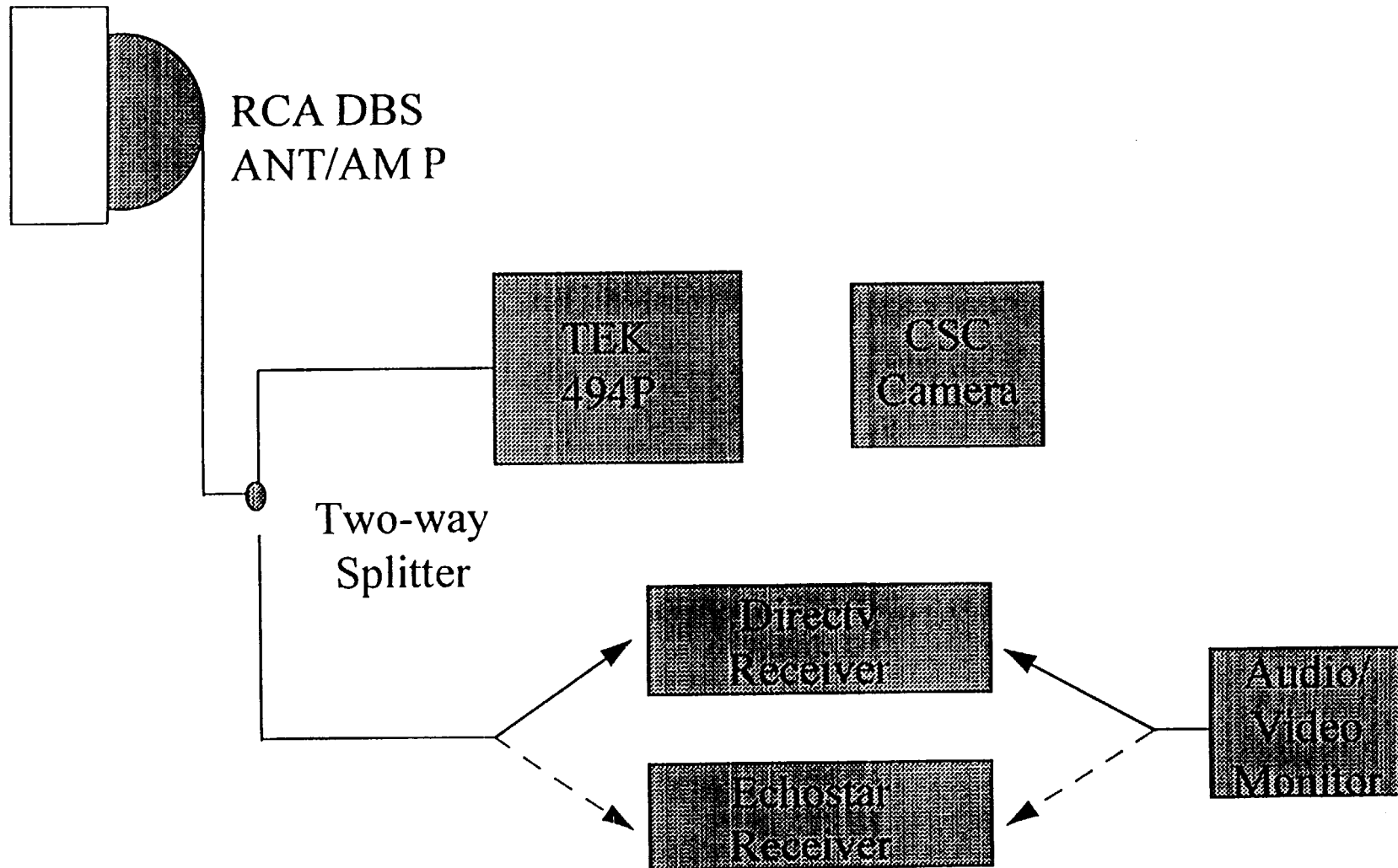


FIGURE 2.5-1

2.6 Interference Testing

The interference effects of the experimental transmitter into the DBS systems were tested at eleven (11) various locations around the transmitter (Figure 2.6-1). Table 2.6-1 presents a listing of the transmitter locations and receive sites.

The transmit antenna was elevated to 52' AGL with a boom lift and positioned on a center azimuth of 180 degrees true with horizontal polarity. This was not changed during the 5 day test period.

At ten of the test sites a line of sight condition between the transmitter and ALL receive test antennas was achieved at a receive centerline of 9' AGL. At one site the receive antennas had to be elevated to 20' AGL to establish a line of sight condition with the transmitter due to tree blockage at 9' AGL.

Once a line of sight condition was verified the Comsearch test set was used to establish an isotropic receive level from the transmitter at full power (29 dBm).

The DBS system was then positioned for DIRECTV and peaked using the display on the 494P analyzer. For DIRECTV tests the transmitter was tuned to 12470 MHz. This frequency is near the center of the transponder that carries Channel 242 (see note below). If interference was present the transmitter was lowered in power until no interference was detected and that level was recorded.

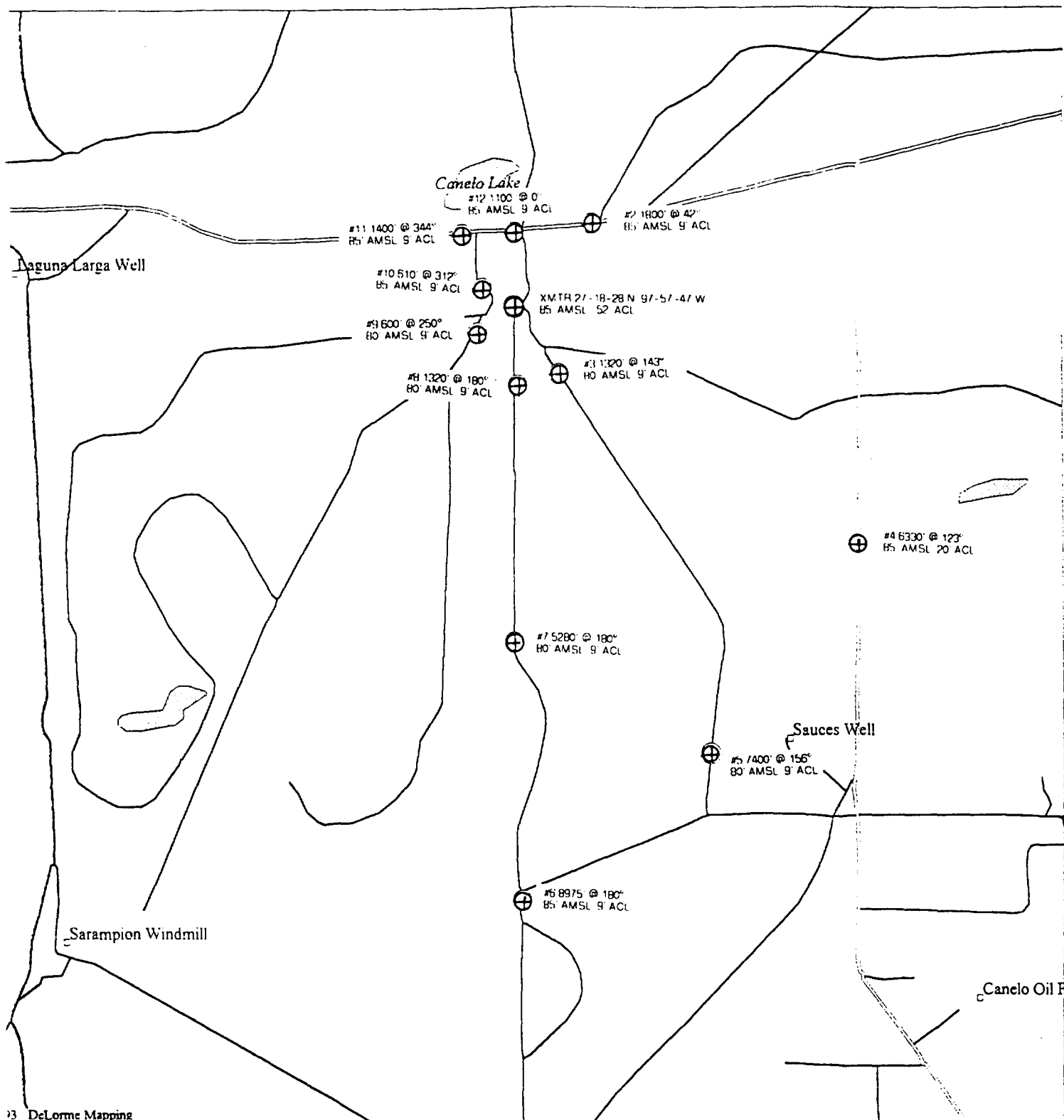
The DBS system was then positioned for ECHOSTAR. The transmitter was tuned to 12460 MHz. The same process as used for DIRECTV was then followed for Channel 220 on ECHOSTAR.

NOTE 1: Since DIRECTV and ECHOSTAR will not release channel loading information, the test frequencies for DIRECTV were derived from previous tests performed by Comsearch Senior Field Engineer, James Branin. The test frequency and channel effected for ECHOSTAR were determined in the field during testing.

12470 MHz is near mid-transponder for the DIRECTV transponder that carries Channel 242.

12460 MHz is near mid-transponder for the ECHOSTAR transponder that carries Channel 220.

It should also be noted that since the DBS signals are TDMA, an interfering signal in any portion of the transponder affects all channels on that transponder equally.



END

Geo Feature

— Street, Road

— Major Street Road

— Open Water

FIGURE 2.6-1

Table 2.6-1

List of Sites - King Ranch, TX - DCE Project

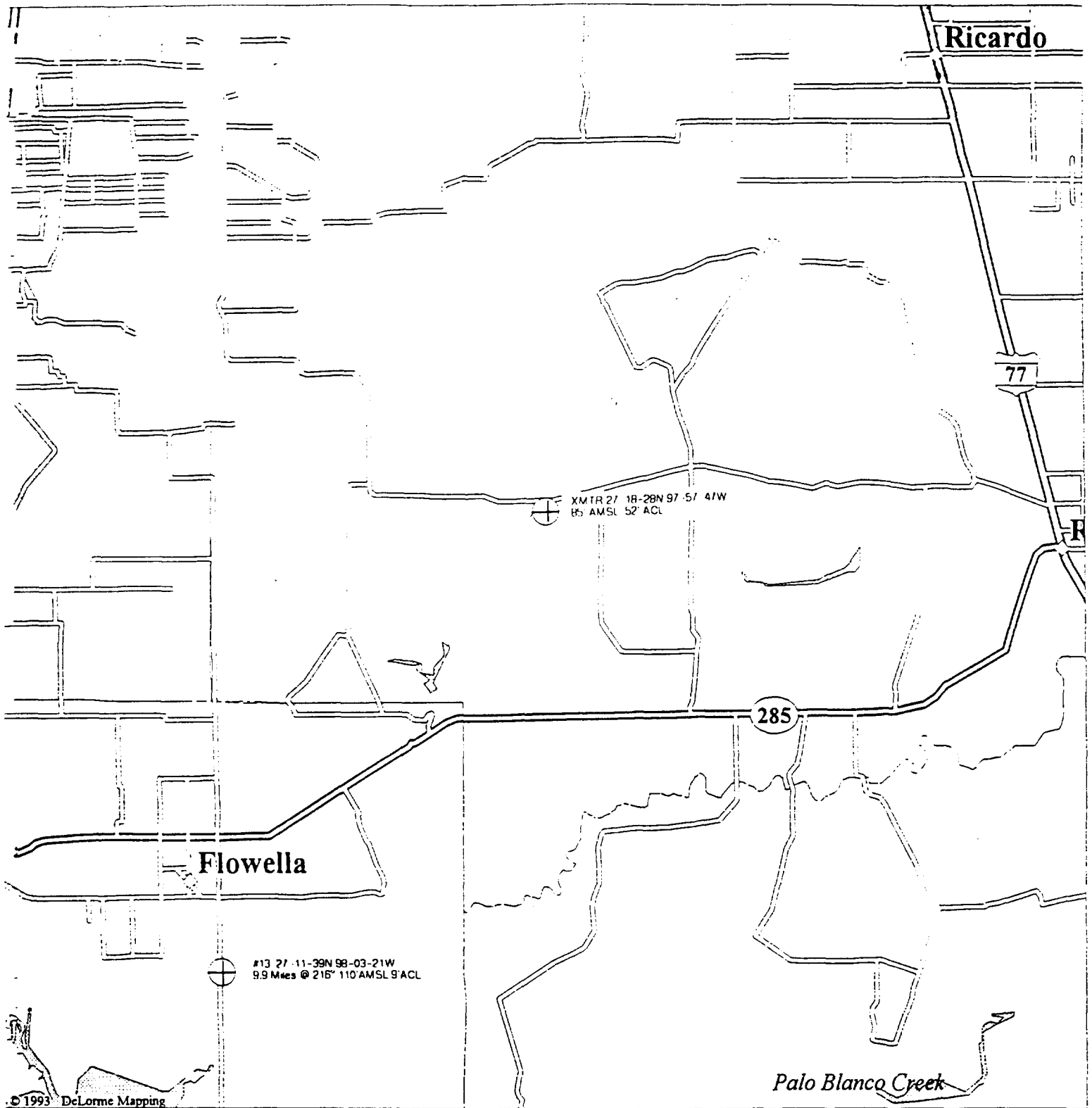
1. TEMPORARY TRANSMITTER	27-18-28 N 85'AMSL 97-57-47 W 52'ACL			
	<u>Coordinates</u>	<u>Distance From XMTR</u>	<u>Azimuth From XMTR</u>	<u>LOS</u>
2. TEST SITE #2	27-18-40 N 97-57-34 W AMSL = 85'	1800' TEST ANT. CL = 9'	42 DEGREES	YES
3. TEST SITE #3	27-18-18 N 97-57-39 W AMSL = 80'	1320' TEST ANT. CL = 9'	143 DEGREES	YES
4. TEST SITE #4	27-17-47 N 97-56-49 W AMSL = 85'	6330' TEST ANT. CL = 20'	123 DEGREES	YES
5. TEST SITE #5	27-17-22 N 97-57-14 W AMSL = 80'	7400' TEST ANT. CL = 9'	156 DEGREES	YES
6. TEST SITE #6	27-17-01 N 97-57-45 W AMSL = 85'	8975' TEST ANT. CL = 9'	180 DEGREES	YES
7. TEST SITE #7	27-17-37 N 97-57-47 W AMSL = 80'	5280' TEST ANT. CL = 9'	180 DEGREES	YES
8. TEST SITE #8	27-18-16 N 97-57-47 W AMSL = 80'	1320' TEST ANT. CL = 9'	180 DEGREES	YES
9. TEST SITE #9	27-18-24 N 97-57-53 W AMSL = 80'	600' TEST ANT. CL = 9'	250 DEGREES	YES
10. TEST SITE #10	27-18-31 N 97-57-52 W AMSL = 85'	610' TEST ANT. CL = 9'	312 DEGREES	YES

	<u>Coordinates</u>	<u>Distance From XMTR</u>	<u>Azimuth From XMTR</u>	<u>LOS</u>
11. TEST SITE #11	27-18-39 N 97-57-55 W AMSL = 85'	1400'	344 DEGREES	YES
		TEST ANT. CL = 9'		
12. TEST SITE #12	27-18-39 N 97-57-47 W AMSL = 85'	1100'	0 DEGREES	YES
		TEST ANT. CL = 9'		
13. TEST SITE #13	27-11-39 N 98-03-21 W AMSL = 110'	9.9 MILES	216 DEGREES	UNK
		TEST ANT. CL = 9'		

2.7 Microwave System Coverage Test

Site 13 was picked for this test. The location is 9.9 miles on an azimuth of 216 degrees true from the transmitter site (Figure 2.7-1).

It is believed that with the transmitter at 85' AMSL plus 52' ACL (137' AMSL) and the receive antenna at 110' AMSL plus 9' ACL (119' AMSL), some tree blockage was present.



LEGEND

- Population Center
- State Route
- Town, Small City
- US Highway
- County Boundary
- Major Street/Road
- State Route
- US Highway
- Airfield

Open Water

Scale 1:150,000 (at center)

2 Miles

5 KM

Mag 11.00

Mon Oct 13 14:54:28 1997

FIGURE 2.7-1

2.8 DBS Antenna Pattern Tests

NOTE: FOR THESE TESTS ONLY, THE L-BAND ISOTROPIC LEVELS REFLECT THE 9 dB DIGITAL BANDWIDTH (8 MHz) CORRECTION FACTOR.

Pattern Test #1: This test was performed 5280' from the transmitter on a bearing of 180 degrees true from the transmitter. The RCA DBS antenna was mounted on the mast at 9' AGL (Ground Elev: 80' AMSL) and set for a 32 degree elevation angle. The transmitter was at 52' AGL (Ground Elev: 85' AMSL) with a pointing azimuth of 180 degrees true.

The isotropic level at the site was verified with the Comsearch test set.

The DBS antenna was rotated through 360 degrees in 15 degree increments and the isotropic levels from the transmitter were recorded.

Pattern Test #2: This test was performed 1320' from the transmitter on a bearing of 180 degrees true from the transmitter. The transmitter was at 52' AGL (Ground Elev: 85' AMSL) pointing on an azimuth of 180 degrees true. The DBS antenna was at 9' AGL (Ground Elev: 80' AMSL) pointing on an azimuth of 180 degrees true.

This site was chosen because it was well within the 17 degree HPBW of the transmit antenna and close enough to the transmitter to observe possible pattern variations when the elevation angle was changed.

The isotropic level was verified with the Comsearch test set.

The DBS antenna was varied in 5 degree increments from 30 - 70 degrees in elevation angle and the isotropic level from the transmitter was recorded.

SECTION 3

MEASUREMENT DATA

In this section the measurement data for the interference level tests and the antenna azimuth and elevation tests is presented.

3.1 Interference Measurement Tests

The interference measurement data is presented in Figures 3.1-1 through 3.1-22.

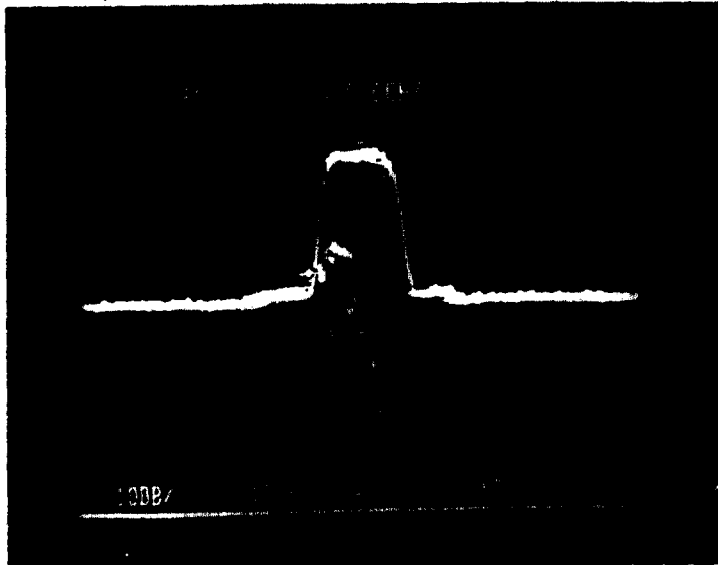
King Ranch, Texas

Azimuth: 222°

Reference
Level
dBm_i

Diversified Communications Engineering

-85



Site #2

Date: October 10, 1997

Time of Day: 1200

Antenna Centerline: 9 Ft.

Polarity: H

XMTR Power: 29 dBm

Level: -92 dBm_i*

* Corrected for digital

Note: 12470 MHz was used for tests
into DIRECTV Channel 242

12460 MHz was used for tests into
ECHOSTAR Channel 220

(A)

Figure 3.1-1 RF Spectrum Analysis

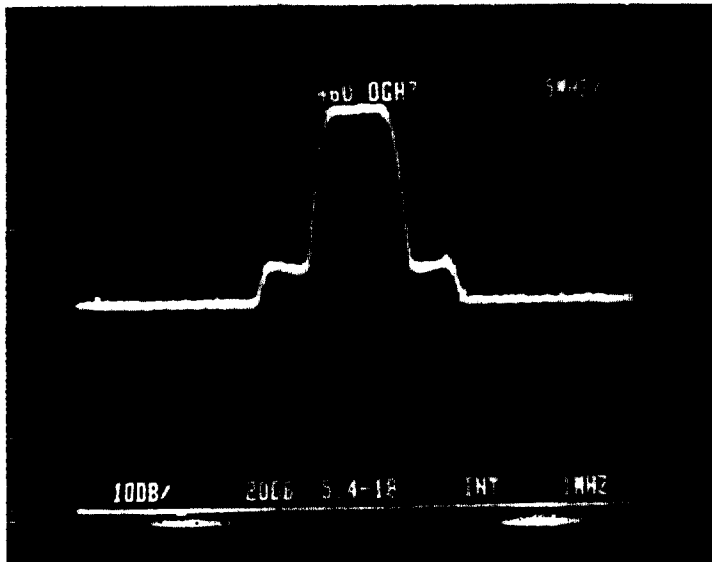
King Ranch, Texas

Azimuth: 323°

Reference
Level
dBm_i

Diversified Communications Engineering

-75



Site #3

Date: October 9, 1997

Time of Day: 1310

Antenna Centerline: 9 Ft.

Polarity: H

XMTR Power: 29 dBm

Level: -73 dBm*

* Corrected for digital

Note: 12470 MHz was used for tests
into ECHOSTAR Channel 242

12460 MHz was used for tests into
ECHOSTAR Channel 220

(A)

Reference
Level
dBm_i

-112



Site #3 ECHOSTAR

RFI Present

XMTR Power: 29 dBm

RFI Level: -114 dBm*

* Corrected for digital

(B)

Figure 3.1-3 RF Spectrum Analysis

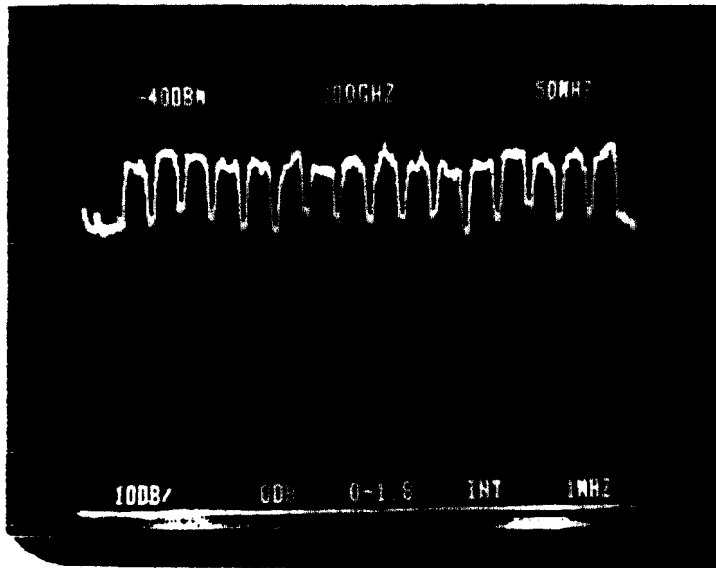
King Ranch, Texas

Azimuth: 186°

Reference
Level
dBm_i

Diversified Communications Engineering

-132



Site #3 DIRECTV
Date: October 9, 1997
Time of Day: 1650
Antenna Centerline: 9 Ft.

Elevation: 58 degrees

XMTR Power: 11 dBm

No interference to satellite
reception

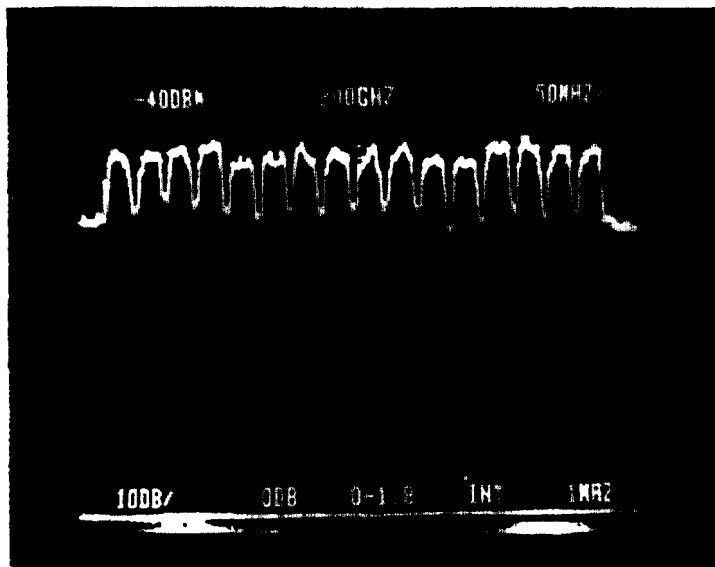
Heavy cloud cover w/ no rain

(A)

Reference
Level
dBm_i

Azimuth: 205°

-132



Site #3 ECHOSTAR
Date: October 9, 1997
Time of Day: 1645
Antenna Centerline: 9 Ft.

Elevation: 56 degrees

XMTR Power: 9 dBm

No interference to satellite
reception

Heavy cloud cover w/ no rain

(B)

Figure 3.1-4 RF Spectrum Analysis

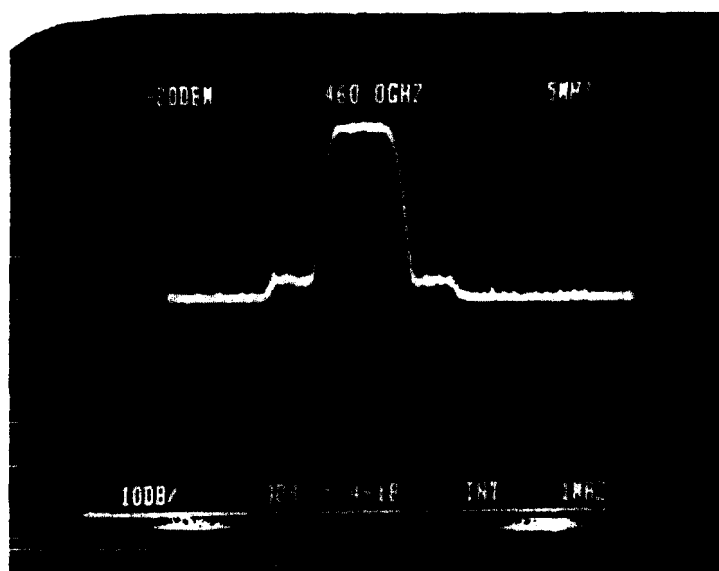
King Ranch, Texas

Azimuth: 323°

Reference
Level
dBm_i

Diversified Communications Engineering

-95



Site #4

Date: October 9, 1997

Time of Day: 1310

Antenna Centerline: 20 Ft.

Polarity: H

XMTR Power: 29 dBm

Level: -96 dBm_i*

* Corrected for digital

Note: 12470 MHz was used for tests
into DIRECTV Channel 242

12460 MHz was used for tests into
ECHOSTAR Channel 220

(A)

Figure 3.1-5 RF Spectrum Analysis

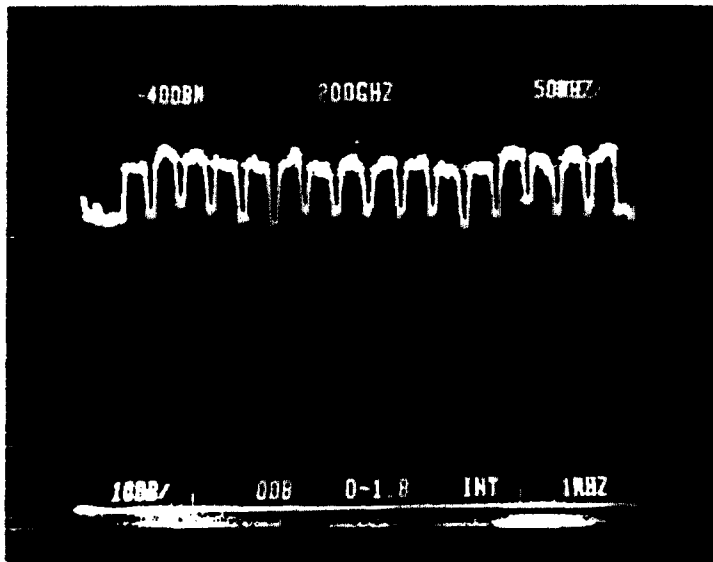
King Ranch, Texas

Reference
Level
dBm_i

Diversified Communications Engineering

Azimuth: 186°

-132



Site #4 DIRECTV
Date: October 9, 1997
Time of Day: 1320
Antenna Centerline: 20 Ft.

Elevation: 58 degrees

XMTR Power: 29 dBm

No interference to satellite
reception

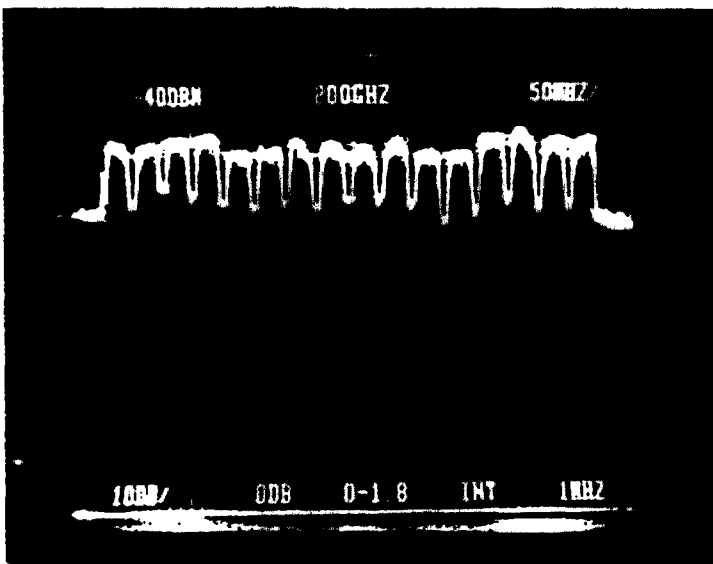
Heavy cloud cover w/ very light rain

(A)

Reference
Level
dBm_i

Azimuth: 205°

-132



Site #4 ECHOSTAR
Date: October 9, 1997
Time of Day: 1325
Antenna Centerline: 20 Ft.

Elevation: 56 degrees

XMTR Power: 29 dBm

No interference to satellite
reception

Heavy cloud cover w/ very light rain

(B)

Figure 3.1-6 RF Spectrum Analysis

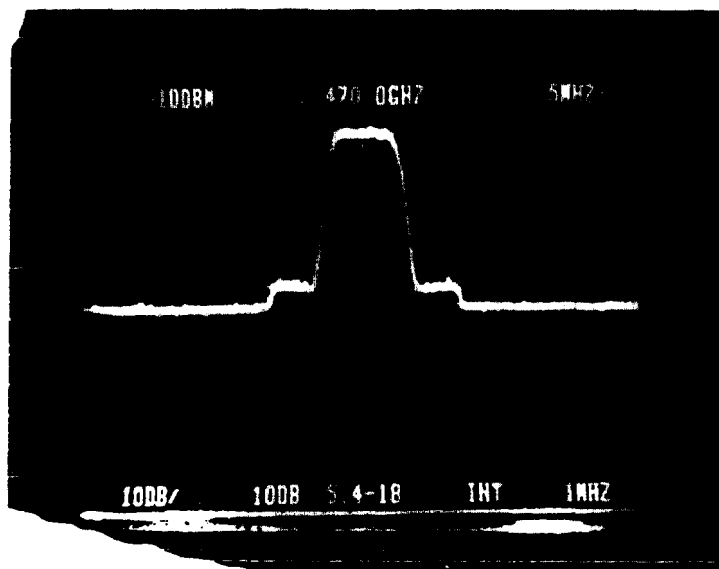
King Ranch, Texas

Azimuth: 336°

Reference
Level
dBm_i

Diversified Communications Engineering

-85



Site #5

Date: October 9, 1997

Time of Day: 1525

Antenna Centerline: 9 Ft.

Polarity: H

XMTR Power: 29 dBm

Level: -87 dBm_i*

* Corrected for digital

Note: 12470 MHz was used for tests
into DIRECTV Channel 242

12460 MHz was used for tests into
ECHOSTAR Channel 220

(A)

Figure 3.1-7 RF Spectrum Analysis

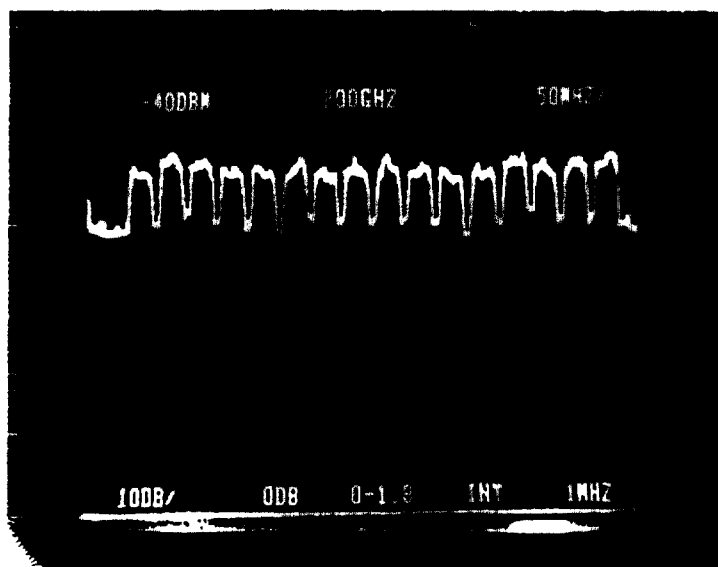
King Ranch, Texas

Reference
Level
dBm_i

Diversified Communications Engineering

Azimuth: 186°

-132



Site #5 DIRECTV
Date: October 9, 1997
Time of Day: 1528
Antenna Centerline: 9 Ft.

Elevation: 58 degrees

XMTR Power: 20 dBm

No interference to satellite
reception

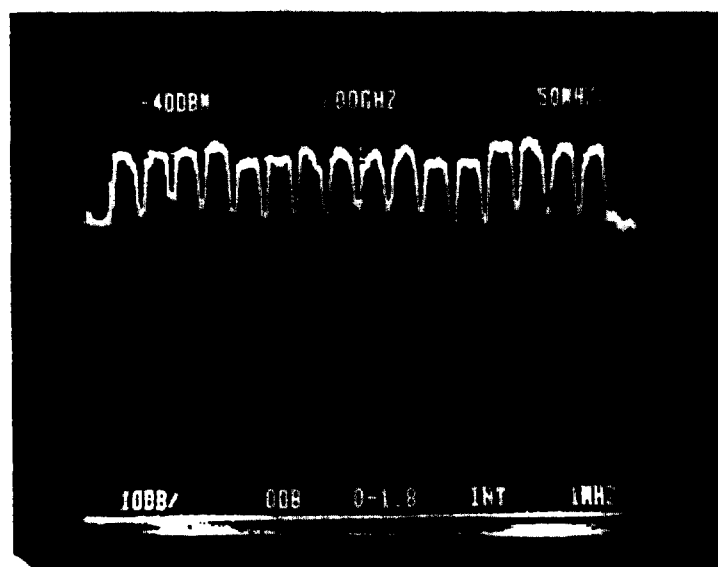
Moderate cloud cover w/ no rain

(A)

Reference
Level
dBm_i

Azimuth: 205°

-132



Site #5 ECHOSTAR
Date: October 9, 1997
Time of Day: 1540
Antenna Centerline: 9 Ft.

Elevation: 56 degrees

XMTR Power: 29 dBm

No interference to satellite
reception

Moderate cloud cover w/ no rain

(B)

Figure 3.1-8 RF Spectrum Analysis

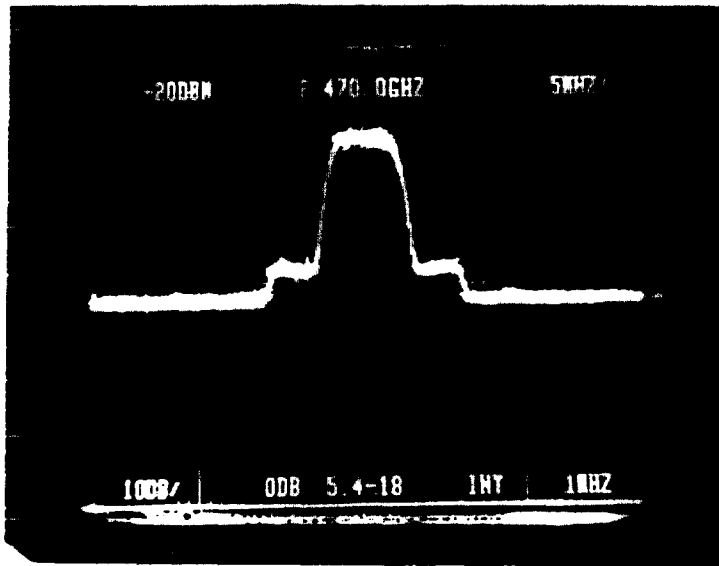
King Ranch, Texas

Diversified Communications Engineering

Azimuth: 0°

Reference
Level
dBm_i

-100



(A)

Site #6

Date: October 8, 1997

Time of Day: 1740

Antenna Centerline: 9 Ft.

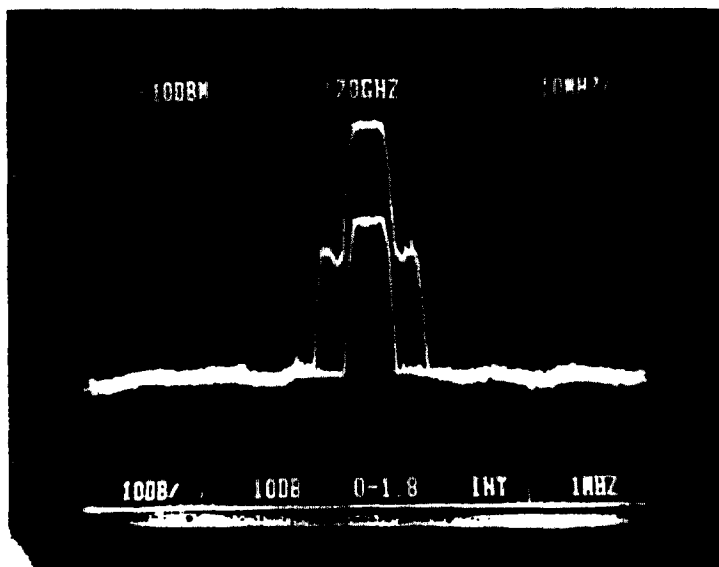
Polarity: H

Level: -104 dBm_i*

* Corrected for digital

Reference
Level
dBm_i

-102



(B)

Azimuth: 0°

Site #6

Date: October 8, 1997

Time of Day: 1750

Antenna Centerline: 9 Ft.

Polarity: H

Upper Trace

Level: -104 dBm_i*

* Corrected for digital

Lower Trace

Level: -122 dBm_i*

* Corrected for digital

XMTR down 18 dB

Video rcv excellent

Figure 3.1-9 RF Spectrum Analysis

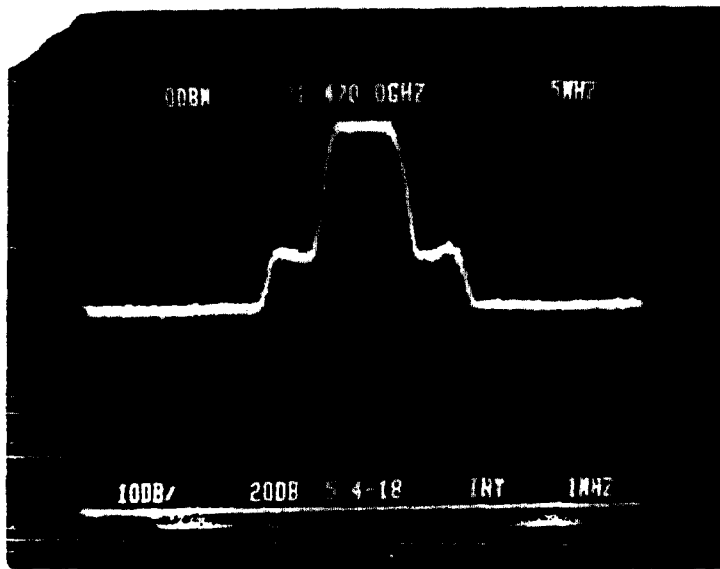
King Ranch, Texas

Reference
Level
dBm,

Diversified Communications Engineering

Azimuth: 0°

-80



Site #7

Date: October 7, 1997

Time of Day: 1500

Antenna Centerline: 9 Ft.

Polarity: H

XMTR Power: 29 dBm

Level: -82 dBm*

* Corrected for digital

Note: 12470 MHz was used for tests
into DIRECTV Channel 242

12460 MHz was used for tests into
ECHOSTAR Channel 220

(A)

Figure 3.1-10 RF Spectrum Analysis

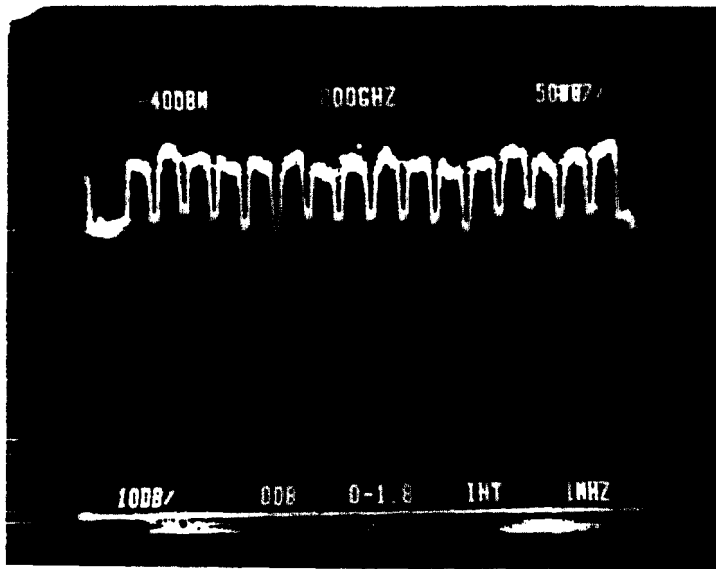
King Ranch, Texas

Reference
Level
dBm_i

Diversified Communications Engineering

Azimuth: 186°

-132

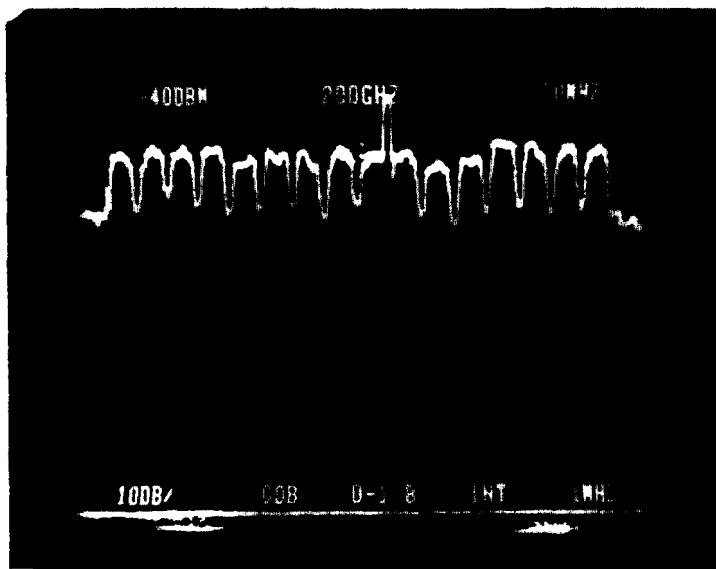


(A)

Reference
Level
dBm_i

Azimuth: 205°

-132



(B)

Site #7 DIRECTV
Date: October 7, 1997
Time of Day: 1537
Antenna Centerline: 9 Ft.

Elevation: 58 degrees

XMTR Power: 29 dBm

No interference to satellite
reception

Light cloud cover w/ no rain

Site #7 ECHOSTAR
Date: October 7, 1997
Time of Day: 1645
Antenna Centerline: 9 Ft.

Elevation: 56 degrees

XMTR Power: 29 dBm

Interference to satellite reception
Light cloud cover w/ no rain

Note: This was the first group of
tests. The test freq. for ECHOSTAR
channel 220 was switched to 12460
MHz to move into the transponder.
For this case interference to
ECHOSTAR was eliminated at:
XMTR Power = 20 dBm

Figure 3.1-11 RF Spectrum Analysis

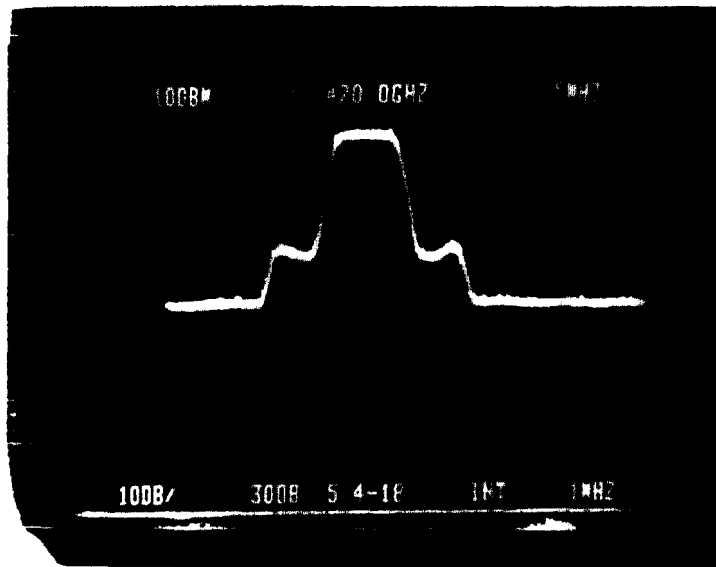
King Ranch, Texas

Azimuth: 0°

Reference
Level
dBm,

Diversified Communications Engineering

-65



Site #8

Date: October 9, 1997

Time of Day: 1015

Antenna Centerline: 9 Ft.

Polarity: H

XMTR Power: 29 dBm

Level: -68 dBm*

* Corrected for digital

Note: 12470 MHz was used for tests
into DIRECTV Channel 242

12460 MHz was used for tests into
ECHOSTAR Channel 220

(A)

Figure 3.1-12 RF Spectrum Analysis